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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant: Qinbai FAN

Serial No.: 10/642,852

Filing Date: 18 August 2003

Title: DIRECT METHANOL FUEL CELL  
ELECTRODE CATALYST

Group No.: 1745

Examiner:  
Chu, Helen Ok

**REPLY BRIEF**

Commissioner for Patents  
Alexandria, VA 22313-1450

Dear Sir:

This is a reply to the EXAMINER'S ANSWER mailed 23 May 2008  
responding to APPELLANTS' BRIEF ON APPEAL filed 29 February 2008  
appealing from the final Office Action mailed 31 December 2007.

I hereby certify that this correspondence (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

03 June 2008

03 June 2008  
Date

Mah R. F.  
Signature

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### **STATUS OF CLAIMS**

Claims 1-14 and 40, all of which stand rejected, are currently pending; Claims 15-39 have been withdrawn from consideration. This Appeal is taken from the decision of Examiner Chu, mailed 31 December 2007, in which Claims 1-14 and 40, inclusive, all of the claims pending in the subject application, were finally rejected. Accordingly, Appellant now appeals Claims 1-14 and 40, inclusive.

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**GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

The first ground of rejection to be reviewed on appeal is whether Claims 1-14 and 40 are unpatentable under 35 U.S.C. 103(a) in view of Srinivas, U.S. Patent Publication No. 2004/0110051 A1 in view of Tripathy et al., U.S. Patent Publication No. 2002/0183470 A1.

### **ARGUMENT**

The invention claimed by Appellant as recited in independent Claim 1 is a fuel cell comprising an anode electrode, a cathode electrode and a proton exchange membrane electrolyte disposed there between. An anode catalyst layer is disposed on the electrolyte facing surface of the anode electrode or the anode electrode facing surface of the electrolyte. The anode catalyst layer comprises a proton conductive material and an electron conductive material substantially uniformly dispersed throughout the catalyst layer. At least one of the proton conductive material and the electron conductive material comprises lignin.

The invention claimed by Appellant as recited in independent Claim 40 is a direct methanol fuel cell comprising an anode electrode, a cathode electrode and a proton exchange membrane electrolyte disposed there between. An anode catalyst layer is disposed on the electrolyte facing surface of the anode electrode or the anode electrode facing surface of the electrolyte. The anode catalyst layer comprises a proton conductive material and an electron conductive material substantially uniformly dispersed throughout the catalyst layer. At least one of the proton conductive material and the electron conductive material comprises lignin.

In accordance with one embodiment of this invention, the lignin may be in the form of ligno-sulfonic acid. In accordance with an alternative embodiment

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of this invention, the lignin is part of a grafted polymer, e.g. polyaniline grafted to lignin.

### **FIRST GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

Claims 1-14 and 40 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Srinivas, U.S. Patent Publication No. 2004/0110051 A1 (hereinafter "the Srinivas publication") in view of Tripathy et al., U.S. Patent Publication No. 2002/0183470 A1 (hereinafter "the Tripathy et al. publication"). The Srinivas publication teaches a composition comprising particulate carbonaceous material and a sulfonated conducting polymer containing hetero atoms. Devices utilizing the composition, which may include a metal, include supported electrocatalysts, membrane electrode assemblies and fuel cells. However, *the Srinivas publication neither teaches nor suggests an anode catalyst comprising lignin* as claimed by Appellant, a fact acknowledged by the Examiner.

The Tripathy et al. publication teaches a method for polymerization of aromatic monomers using derivatives of hematin including assembled hematin. In one embodiment, the polymerization is carried out in the presence of a template, along which aromatic monomers align. Assembled hematin includes alternating layers of hematin and a polyelectrolyte, which are deposited on an electrically charged substrate (Abstract). The Tripathy et al. publication also teaches the use of electrically

conductive polymers in a variety of electronic devices including electro-chromic devices, light-emitting diodes, electrostatic discharge protection, and light weight batteries (Paragraph [0003]). *Nowhere does the Tripathy et al. publication teach the use of electrically conductive polymers comprising lignin in fuel cells.* In addition, the Tripathy et al. publication also teaches a method for producing lignosulfonate-Pani complex using hematin (Paragraph [0069]). *Nowhere does the Tripathy et al. publication teach or suggest the use of a lignosulfonate-Pani complex as part of an anode catalyst layer which is both proton and electron conductive employed in a fuel cell as claimed by Appellant.* Appellant further respectfully urges that the Tripathy et al. publication does not teach or suggest the use of a lignosulfonate-Pani complex as a component of a proton conductive material in accordance with certain embodiments of the invention claimed by Appellant. Thus, Appellant respectfully urges that it is mere conjecture on the part of the Examiner as to the suitability of a lignosulfonate-Pani complex for use in the anode catalyst layer of a fuel cell as claimed by Appellant.

### **Response to Examiner's Arguments**

The Examiner argues at Page 6, lines 1-6 of the Examiner's Answer that the Tripathy et al. reference teaches that the lignosulfonated-Pani (polyaniline) complex taught therein, i.e. a conductive polymer, may be used in electronic devices

such as a fuel cell. In support of this argument, the Examiner cites Paragraph 3 of the Tripathy et al. reference. Paragraph 3 of the Tripathy et al. reference states as follows:

“Recently, there has been an increased interest in tailored development of polyaromatic polymers, particularly polyaromatic polymers that are electrically conductive and/or have interesting and useful properties. Examples of electronically conductive polymers include certain polyanilines, polythiophenes, polypyrroles, and polyphenols. These conductive polyaromatic polymers may be used in a variety of electronic devices, including electro-chromic devices, light-emitting diodes, electrostatic discharge protection, and light weight batteries. Of these polyaromatic polymers, polyanilines are the most extensively studied, due largely to superior electrical properties such as high discharge capacity.”

Appellant respectfully urges that, contrary to the assertion by the Examiner, *nowhere in the above reproduced Paragraph 3 of the Tripathy et al. reference is there any mention of fuel cells*, much less the suitability of the polymers discussed therein for use in fuel cells. Thus, the Examiner appears to be arguing that the phrase “a variety of electronic devices” can be interpreted to include fuel cells, notwithstanding the fact that there is no specific mention of fuel cells anywhere in the Tripathy et al. reference. The Examiner further argues that it is obvious to use the conductive materials of the Tripathy et al. reference as conductive polymers in fuel cells because the anodes of fuel cells are known in the art to require conducting materials. That is, according to the Examiner, any conductive polymer may be used in the anode of a fuel cell.

Appellant respectfully urges that, in determining the suitability of a conductive polymer for use in a fuel cell, the conditions of operation of the fuel cell as well as the suitability of the conductive polymer for a desired purpose must be taken into consideration. As discussed at Page 9, line 21 to Page 11, line 2, the claimed invention involves the modification of the anode catalyst layer to reduce or effectively eliminate methanol flow into and/or through the electrolyte membrane of a direct methanol fuel cell. The modification involves the use of a proton and/or electron conductive material comprising lignin, e.g. polyaniline grafted to lignin, as a component of the catalyst layer of the anode electrode. The Examiner's argument would suggest that any proton and/or electron conductive polymer, simply by virtue of its being conductive, will function in the manner of Appellant's claimed invention. However, because, until the invention claimed by Appellant, the problem of methanol crossover in direct methanol fuel cells employing anodes with conductive polymers (e.g. NAFION as discussed at Page 7, line 19 to Page 9, line 7 of the specification of the subject application) persisted, it is clear that not all conductive polymers are suitable for use in direct methanol fuel cells. Thus, Appellant respectfully urges that electron and/or proton conductivity of a polymer, by itself (i.e. absent any teachings as to the use of the polymer in a fuel cell as in the instant case), is not sufficient for



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determining the suitability of the polymer for use in a fuel cell, much less for a given purpose in a fuel cell.

The Examiner has further argued that an undated catalog page from the internet version of the Sigma-Aldrich Chemical Company catalog states that polyaniline grafted to lignin can be used as a fuel cell material. The basis for this argument is the fact that the polymer is listed in a section of the catalog labeled as "Fuel Cell/Battery Materials." Appellant has previously argued that disposition of the reference page in a section of a catalog labeled "Fuel Cell/Battery Materials" does not mean that all of the materials listed therein are suitable for both fuel cell and battery applications, particularly given the fact that fuel cells, which are energy conversion devices, and batteries, which are energy storage devices, are not functional equivalents. Appellant has also previously noted that the Sigma-Aldrich reference explicitly states that polyaniline (emeraldine salt) is "*an additive in polymer blends and liquid dispersions for electromagnetic shielding, charge dissipation, electrodes, batteries and sensors,*" a list from which *fuel cells is notably absent*. Appellant notes that this statement of uses is consistent with the explicit teachings of the Tripathy et al. reference as discussed herein above. Nowhere has the Examiner addressed the exclusion of fuel cells from the list stated by the Sigma-Aldrich reference.

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Appellant has also previously argued that the Sigma-Aldrich reference is not a proper reference as it is an undated reference. In support of this argument, Appellant cited MPEP § 2128, which states under the section entitled “Date of Availability” that

“Prior art disclosures on the Internet or on an online database are considered to be publically available as of the date the item was publically posted. If the publication does not include a publication date (or retrieval date), it cannot be relied upon as prior art under 35 U.S.C. 102(a) or (b).”

In response to this argument, the Examiner has argued that, pursuant to MPEP § 2124 **Exception to the Rule That the Critical Reference Date Must Precede the Filing Date**, the teachings of the Sigma-Aldrich reference constitute the expression of a “universal fact” or “scientific truism”. Appellant respectfully urges that an entry in a catalog of materials for sale by a company in no way constitutes a “universal fact” or “scientific truism” as argued by the Examiner. A catalog is nothing more than a list of goods available for sale. If a company decides that it no longer wishes to offer an object for sale and, thus, removes the object from the catalog, does that mean that the removed object, which, in accordance with the argument of the Examiner, constitutes a universal fact by virtue of its being listed in the catalog is no longer a universal fact? Appellant respectfully urges that, given the frequency with which catalogs are typically published and the listings in catalogs are changed, with

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additions and deletions, an undated page from such a catalog is not a proper reference, even under the exception of MPEP § 2124.

### **SUMMARY OF ARGUMENTS**

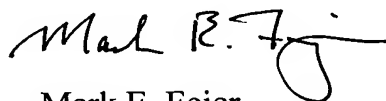
The crux of the invention claimed by Appellant is the use of a proton conductive material and/or electron conductive material comprising lignin as a component of the anode catalyst of a fuel cell. Two references, the Srinivas publication and the Tripathy et al. publication, have been combined by the Examiner for rejection of the subject application on the basis of obviousness. A third, undated, reference, while not specifically relied upon by the Examiner for rejection of the subject application, has nevertheless been cited by the Examiner in support of the rejection of the subject application. The Srinivas publication teaches a composition comprising particulate carbonaceous material and a sulfonated conducting polymer containing hetero atoms for use in supported electrocatalysts, membrane electrode assemblies and fuel cells. The Tripathy et al. publication teaches the use of electrically conductive polymers in a variety of electronic devices including electrochromic devices, light-emitting diodes, electrostatic discharge protection, and light weight batteries, as well as the use of a lignosulfonate-Pani complex as a component of an electron conductive material. Appellant respectfully urges that the totality of the teachings of the prior art relied upon by the Examiner for rejection of the subject

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application does not, in fact, teach or suggest the invention claimed by Appellant and, thus, does not render Appellant's claimed invention obvious.

Accordingly, Appellant respectfully requests that the final rejection by the Examiner be reversed.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Mark E. Fejer", with a stylized flourish at the end.

Mark E. Fejer  
Regis. No. 34,817

Gas Technology Institute  
1700 South Mount Prospect Road  
Des Plaines, Illinois 60018  
TEL (847) 768-0832; FAX (847) 768-0802